INDEX

Abstraction hierarchy, 176–177, 181–185
  for case cart preparation, 186
  for sterilization, 184
Alarm
  desensitization, 137–138
  suppression, 169
"Alert, verbal, pain, unresponsive" scale (AVPU scale), 236–237
Algorithm-based patient assessment approaches
  algorithm development approaches, 235–236
  considerations, 236–237
  intensive care illness severity scores, 234–235
  literature review of, 230–237, 231–233
  pre-operative and post-anesthesia care level risk assessment scores, 230–234
  "track and trigger" algorithms, 235
  See also System-based approaches for hospitals
American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP), 230–234
  calculator, 238
American Heart Association (AHA), 161
American Society of Anesthesiologists (ASA), 230

Bartlett's Test of Sphericity, 105
Beryl Institute, 256
"Best Care at Lower Cost" report, 198–199
Blood-stream infections (BSIs), 38
Burnout, 100–101, 102
  professionals, 104
  structural equation model, 109

Cardiac monitoring days (CMD), 161, 163–164
Care coordination, 239, 240–241
Case cart preparation, 174, 176–177, 179–180, 193–194
Centers for Disease Control and Prevention (CDC), 62–63
  Fluview, 63–64
Clinical
  decision support tools, 77
  environment, 104–105
  patient-safe working environments, 101
  quality, 259–260
  reasoning skills, 243
  space design, 77
Computer-based GIS applications, 62–63
Conservation of Resources Theory, 104
Continuous cardiac monitoring (CCM), 160–161
  guidelines for effective, 161
  interventions, 161–162
  methods, 162–164
  orders, 162
  patient classification, 163
  policy, 169
  results, 164–165

Continuous learning health care system, 198–199
case setting, 201–202
cultural catalyst and deterrent themes and sub-themes, 216–218
cultural enabler and motivator themes and sub-themes, 207–215
cultural evolution, 204–214
data analysis and interpretation, 202–204
practice implications, 223
procedures and data sources, 202
study design overview, 200–201
theory, 200
See also Health care
Cultural/culture, 200
catalysts, 206, 216–218, 221
deterrents, 206, 216–218, 221
evolution model, 204–214

Data
consumers, 245–246
data-driven approaches, 235–236
producers, 245–246
source review and open coding, 202–204

E-prescribing system, 12–13
Early warning scores (EWS), 235
Electronic health record (EHR), 63–64, 67, 161
Electronic medical record (EMR), 136–137, 237
Emergency department (ED), 160–161
boarding rate, 163–164, 166–169
Ethnography, 199, 200–201, 203
Exploratory factor analysis (EFA), 105
Extended Control Model (ECOM), 130, 131, 140

Failure Modes and Effects Analysis (FMEA), 194
Failure to rescue events (FTR events), 228–229
analysis goals and assessment approach, 122–124
case example, 121–122
improvement investigation, 229
leverage point analysis, 134–144
macro-level systems analysis, 124–134
mitigation system analysis, 121, 147
opportunity for systems analysis of patient safety programs, 120–121
system requirements development and intervention selection, 144–146
Foley catheters, 45, 46

General Surgical Care, 129–130
Geographic information systems (GIS), 62–63
analysis of research gaps, 66–67
challenges to implementation of Hospital GIS, 70, 71
complexity assessment using NASSS framework, 67–69
design/methodology/approach, 64–65
future directions, 72
GIS for infection prevention, 65–66
hospital GIS for outbreak investigation, 66
limitations, 71–72
originality/value, 72
targeted literature review, 65–66
Glasgow Coma Scale (GCS), 236–237
Goodness of fit index (GFI), 107–109, 111

Health care
delivery in modern hospitals, 146
delivery units, 37–38
design, 20–21
environment, 20–21, 40
landscape, 20
process model development to guide change, 22–23
PRODUCE, 23–31
professionals, 12, 104
services, 199
systems approach in, 38–39, 120, 198–199
Health information technology (HIT), 38, 75–76, 92–93
Healthcare-associated infections (HAIs), 36
central venous catheter, 48
complex system risk of infection model, 39–41
fractional factorial experimental design, 58–59
mixture design and contour plot development, 53–57
model validation and optimization, 42
risk, 47
systems approach in health care and infection control, 38–39
systems model to simulate and identify effective interventions, 43–47
See also Hospital-acquired infection (HAI)
Hospital design, 3, 5, 10
Hospital GIS, 63–64, 65, 67, 72
challenges to implementation of, 67–69, 71
for outbreak investigation, 66
See also Geographic information systems (GIS)
Hospital-acquired infection (HAI), 62
See also Healthcare-associated infections (HAIs)
Human factors, 75–77
analysis to derive design requirements, 84–85
application to physical space design, 78
approach, 101
data collection, 79–85
evaluating candidate design plan against design requirements, 85
expert evaluation, 85–87
findings, 87–91
identifying vulnerabilities in proposed design, 85–87
implications, 92–94
in-depth individual interviews, 80–83
Interim Build design concept assessment, 91
methods, 79–87
metrics development, 87
NICU redesign effort, 78–79
observations, 83–84
recommendations, 91
revisions to design plan, 91
stakeholder meeting, 79–80

Illness-severity scores, 230
Individuals and Moving Range charts (I-MR charts), 164
Infection prevention, GIS for, 65–66
Institute for Healthcare Improvement's Framework for Spread, 200
Institute of Medicine (IOM), 75–76
Integrated system approach to design, 239–248
clinical workflow design, 241–245
control model of patient care, 242
flowchart of notification process, 245
general information flow concept, 243
information systems infrastructure model, 245–246
initial stakeholder preferences, 240

modeling, 130–132
observations from current state data and algorithm literature review, 239–240
pilot implementation planning, 246–248
scope and objectives, 240–241
Intensive care unit (ICU), 126, 162, 230
See also Neonatal Intensive Care Unit (NNICU); Surgical critical care unit (SICU)
Interim Build design, 79–80, 81–83
Intraorganizational Model for Developing and Spreading Quality Improvement Innovations, 200
Intravenous medication (IV medication), 48

Job Demands-Resources Model (JD-R Model), 101–102, 104, 112

Latent safety threat (LST), 21–22
Law of Stretched Systems, 166–169
Lean Six Sigma-based competency development program, 123, 238
Leverage point analysis, 134–144
current state analysis, 138–140
driver diagram, 145
dynamic system modeling, 140–141
evidence review, 134–138
excerpt of requirements document, 146
inpatient rescue data analysis, 139
integrated fishbone diagram, 143
people and teams, 134–136
simulation of patient deterioration, 141
stakeholder feedback and analysis integration, 142–144
technology and socio-technical issues, 136–138
See also Macro-level systems analysis
Licensed nursing assistants (LNAs), 129–130
Life Safety Program, 127
Light(ing), 7–8
optimization, 7–8

Machine learning approaches, 235
Macro-level systems analysis, 124–134
current state analysis, 127–130
evidence review, 126–127
institutional-level baseline data for general and FTR specific metrics, 128
integrated system modeling, 130–132
process and resource mapping, 129
stakeholder knowledge elicitation and identification of key system leverage points, 132–134
See also Leverage point analysis
Macro-system
enablers, 206–215, 220–221
motivators, 206–215, 221
Maslach's burnout measure, 113–114
Medical error(s), 2, 3, 75–76
in obstetric departments, 100–101
Methicillin-resistant *Staphylococcus aureus* (MRSA), 38–39
Model for Understanding Success in Quality (MUSIQ) model, 200
Modified Early Warning Score (MEWS), 238
Multi-drug resistant organisms (MDROs), 62

National Early Warning Score (NEWS), 235
Neonatal Intensive Care Unit (NNICU), 29–31, 77
redesign effort, 78–79

Noise reduction, 8–9
Nonadoption, abandonment, scale-up, spread, and sustainability framework (NASSS framework), 64–65
  complexity assessment using, 67–69
Nudging
  to raise compliance, 12–13
  solutions, 4–5
Nurses, 243–244

Obstetric care, study of, 99
  hypothesized model of study, 105
  item statements, 106
  limitations, 113–114
  method, 105–106
  model fit indices, 111
  one-way analysis of variance, 110
  results, 107–111
  theoretical framework, 103–105
Ohio State University Wexner Medical Center (OSUWMC), 162

Patient assessment, 239
  integrated systems approach to design, 239–248
  literature review of algorithm-based patient assessment approaches, 230–237
  score calculations, 236
  study hospital current state system information, 238–239
  tools, 229
Patient experience, 256
  analysis, 258
  data collection, 257
  demographics, 258
  metrics of success, 258
  multidimensional definition, 256–257
  performance measures beyond satisfaction scores, 259
  satisfaction, 256
  sharing of data, 259
  survey instrument, 257
Patient safety, 93, 100, 228, 259–260
  good practices for improving, 7–13
  opportunity for systems analysis of, 120–121
Patient Safety Indicator 4 (PSI4), 127
Pediatric Index of Mortality (PIM2), 39–40
Performance improvement (PI), 257
Performance measurement, 247–248
Portsmouth Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity (P-POSSUM), 234, 237
Post Anesthesia Recovery (PAR), 234, 237
Post-anesthesia care unit (PACU), 30–31, 129–130, 234
Process for design of user-centered environments (PRODUCE), 23–31
  assessing outcomes, 28
  construction, 25–26
  design, 23–25
  post go-live, 27
  pre-opening, 26–27
  putting PRODUCE into practice, 31
  scaling model, 28–29
  women's services and neonatal intensive care, 29–31

Quality of patient experience, 259–260
Quick Sequential Organ Failure Assessment Score for Sepsis (qSOFA), 235

Registered nurses (RNs), 80–81
Rescue
  activation, 239
  system, 127

Risk
algorithms, 237
analysis model, 40
model, 40–41, 42
risk-based index, 40
scoring mechanisms, 47

Safety, Communication, Operational Reliability and Engagement survey (SCORE survey), 129–130
Salmonella enteritidis, 66
Sequential Organ Failure Assessment Score (SOFA Score), 235
Sexton's tool version, 113–114
Simplified Acute Physiology Score 3 (SAPS 3), 234
Stakeholder
knowledge elicitation, 132–134
meeting, 79–80
Steam sterilizers, 179
Sterile processing
abstraction hierarchies, 181–185
approach, 176
basic system description, 177–180
case cart interruptions, 189–191
department (SPD), 174, 175
design and setting, 175–176
general observations, 189
generalizability, 192
HTA, 181
limitations, 194–195
modeling, 176–177
performance sampling, 177, 189–192
tray defect data, 192
variance matrix, 185–189
Structural Equation Modeling (SEM), 105–106
of burnout, 109
Structural model of burnout (SMOB), 104
Subjective, Objective, Assessment, Plan (SOAP), 244
Supporting services, 23–24
for patient experience, 256–257
Surgical critical care unit (SICU), 129–130
Surgical site infections (SSIs), 62
System-based approaches for hospitals, 6–7
conceptual framework, 3–6
creating health-promoting environment, 5–6
directly reducing risks, 4
encouraging intuitive, safety-promoting behavior, 4–5
good practices for improving patient safety by design, 7–13
in health care, 229
noise reduction, 8–9
nudging to raise compliance, 12–13
optimizing latent conditions, supporting staff performance levels, 4
optimizing lighting, 7–8
reduction of interruptions, 9–11
standardization, 11–12
See also Algorithm-based patient assessment approaches
Systemic inflammatory response syndrome (SIRS), 234
Systems engineering, 229, 242
approaches, 121
Systems Engineering Initiative for Patient Safety (SEIPS) model, 23–24, 38, 101, 176–177
SEIPS 2.0 model, 20–21, 22, 77

"Track and trigger" algorithms, 230, 235–236

Unit support assistants (USAs), 129–130
University Health System Consortium, 163–164
Urinary tract infections (UTIs), 38
User-centered design, 21–22, 23, 25

User-centered health care environment, 22

Vancomycin-resistant *Enterococcus* (VRE), 39
Variance matrix, 176–177, 185–189
  for case cart preparation, 190–191
  for sterilization and case cart preparation, 187–188
Ventilator-associated pneumonia (VAP), 38, 45
Visibility, 80, 87
  effective, 85–87

Welch's two group t-test, 164
Women's services and neonatal intensive care, 29–31
  World Health Organization (WHO), 8